

Digital Milliohmmeter BT51

USER GUIDE

GUIDE DE L'UTILISATEUR

GEBRAUCHSANLEITUNG

GUÍA DEL USUARIO



Safety Warnings

- **Safety Warnings** and **Testing Precautions** must be read and understood before the instrument is used. They must be observed during use.
- Circuit under test **must** be switched off, de-energised and isolated **before** any test connections are made.
- Test leads and handspikes **must** be in good order, clean and with no broken or cracked insulation.
- Circuit connections **must not** be touched during a test.
- The instrument must be earthed (grounded) when connected to a mains power source (for battery charging).
- Replacement fuses **must** be of the correct type and rating.
- The instrument should **not** be used if any part of it is damaged.
- Refer to pages 8 and 9 for further explanations and precautions.

NOTE

THIS INSTRUMENTS MUST ONLY BE USED BY SUITABLY TRAINED AND COMPETENT PERSONS.

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General Description

The BT51 uses the four terminal measurement principle. Current generated within the instrument, passes between the current terminals C1 and C2 via the test sample. The voltage across the test sample is measured across the potential terminals P1 and P2.

The test current, of nominally 2A, is measured by monitoring the voltage drop across an internal series resistor. The instrument compares this voltage with the voltage across the P1 and P2 terminals and a ratiometric measurement is performed. On the lower range a voltage amplifier is used. Because the measurement is ratiometric the reading is unaffected by minor variations of test current.

There are two measuring ranges, 2000 m Ω and 20 m Ω , selected by the rotary switch that is also used to turn the instrument off. The readings are indicated on a 3½ digit light emitting diode display which is easily seen in poor lighting conditions.

A green L.E.D. indicator light glows when the test current is passing between the C1 and C2 terminals as a test is made. A red neon light adjacent to the terminals, illuminates as a warning of the presence of a dangerous voltage, should the test lead probes be accidentally placed across a "live" circuit. The instrument incorporates a relay protection circuit (effective up to 240 V a.c.) should such a connection occur. This protection becomes operative at low voltages and

the neon warning light shows when a dangerous voltage is present. Both the neon warning light and the protective relay are effective irrespective of whether or not the instrument has been turned on prior to the probes being placed across the voltage source.

Power for the instrument and the test circuit is obtained from internal rechargeable NiCd cells. When the battery needs recharging a red L.E.D. "low battery voltage" warning light illuminates next to the display. An integral charger unit is fitted accompanied by, a warning neon light to show when the battery is under charge, and a fuse for protection.

Note:— It is advisable to ensure that the battery cells are fully charged before embarking upon any tests.

The instrument is contained in a robust plastic case with a hinged detachable lid that will automatically become unclipped if it is accidentally thrown or dropped open, thus preventing damage to the hinges.

A variety of test lead sets, some with duplex handspikes are available as optional extras.

Applications

The BT51 is designed to measure the resistance of the bonding of metalwork on large frames and structures, earth bonds, cable bonds, lightning conductors etc. and to check bus bar continuity. It is also able to measure the resistance of the bonding of metalwork on aircraft. It has a resolution of 0,01 m Ω , and is able to check the resistance between metal points on the aircraft structure.

Power cord:

If the power cord plug is not suitable for your type of socket outlets (receptacles), do not use an adaptor

You should use a suitable alternative power cord, or if necessary change the plug by cutting the cord and fitting a suitable plug.

The colour code of the cord is:

Earth (Ground)	Yellow/Green
Neutral	Blue
Phase (Line)	Brown

Symbols used on the Instrument



Caution, refer to accompanying documents



Equipment complies with current EU Directives

If using a fused plug, a 3 Amp fuse to BS 1362 should be fitted.

Note: A plug severed from the power cord should be destroyed, as a plug with bare conductors is hazardous in a live socket outlet (receptacle).

Specification

Ranges	2000 mΩ resolution 1 mΩ 20,000 mΩ resolution 0,01 mΩ
Test current	2 A to 2,5 A at any reading
Accuracy (0 °C to 50 °C)	± 1% ± 2 digits
Display	3½ digit L.E.D.
Temperature Range	Operating 0 °C to +50 °C Storage -20 °C to +50 °C
Protection 240 V model 115 V model	Relay protection for up to 240 V a.c. power source applied 100 mA (T) fuse 20 mm x 5 mm ceramic (For charging circuit) 250 mA (T) fuse 20 mm x 5 mm ceramic (For charging circuit)
Power Supply	Internal 4 Ah NiCd rechargeable cells and charging unit. Normal charging time at 240 V is 10 hours
Safety	The instruments meet the requirements for double insulation to IEC 1010-1(1995), EN 61010 (1995).
E.M.C.	In accordance with IEC 61326 including amendment No. 1
Dimensions	344 mm (13½ ins) x 245 mm (9¾ ins) x 158 mm (6¼ ins)
Weight	4,5 kg (10 lb)
Cleaning	Wipe disconnected instrument with a clean cloth dampened with soapy water or Isopropyl Alcohol (IPA).

Operation

WARNING

Ensure that the equipment or conductor to be tested is de-energised before connecting the instrument.

THE DETACHABLE LID

The lid hinges are fitted with spring loaded clips and are designed in this way for two reasons. Firstly, if the lid is accidentally thrown open to its full extent, the hinges will not be strained or broken but the lid will be safely unclipped. Secondly, the lid can purposely be removed, if required, when the instrument is in use by simply opening it up to its full extent and gently pressing down on the opening edge while holding the tester body firm. The hinges will then unclip.

To replace the lid, hold it vertically and push the hinges back into their clips again while restraining the instrument, then fold the lid shut.

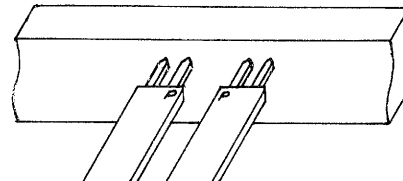
PERFORMING A TEST (assuming duplex handspikes are used)

1. Connect the test leads to the instrument terminals, current leads to C1 and C2, potential leads to P1 and P2.

Note:— Duplex handspikes provided by **Megger Limited**, are identified as follows: The current lead is black and the spade connector is stamped with a 'C', the potential lead is red and the spade connector is stamped with a 'P'. On the handspikes themselves, the potential spike is marked with a 'P'.

2. Turn the range selector switch to the appropriate position.

3. If it is desired, check that the instrument is functioning correctly by touching the two handspikes onto a known low resistance piece of metal with the potential spikes as close as possible to each other.



A zero reading should be obtained on the digital L.E.D. display.

Note:— Current will only pass when the circuit is completed between the C1 and C2 spikes. The green L.E.D. light will illuminate to indicate when this occurs.

Make sure also that the low battery warning light does not illuminate.

4. Press the handspike sets down on to the equipment or conductor to be tested. (The handspikes may be as far apart as the lead length will allow).

5. Read the resistance measured from the digital display.
6. If the over-range symbol appears on the display when the 20 m Ω range is in use i.e. a '1' as the left hand digit with the remaining L.E.D's blank, turn the selector switch to the 2000 m Ω range and repeat the test.

If the over-range symbol (i.e. a '1' as the left hand digit) appears again the resistance being measured is outside the range of the instrument.

7. After testing remove the handspikes, turn the selector switch to 'Off' and disconnect the test leads.

Caution:— When the instrument is used for measuring an inductive load, a voltage spike will appear across the terminals. This occurs when the instrument is switched between ranges or the test leads are connected or disconnected. The instrument will withstand voltage spikes caused when measuring inductive loads (which include the test leads) of up to 250 mH.

USING ALTERNATIVE LEADS

For any of the C1, C2, P1 and P2 connections, test leads terminated with bulldog clips or clamp connectors may be used. Single handspikes are also suitable.

Alternative test leads are available from **Megger Limited** (see Accessories, page 15).

The testing procedure as given above should be followed.

However, it must be remembered when using fixed current connections, that as soon as the connections are made and the circuit completed, the test current will flow unless the selector switch is in the 'Off' position. Therefore, in order to conserve battery power, it is advisable, whatever type of connections are used, to keep the time for the

test as short as possible.

With the fixed type of current connections, keep the selector switch in the 'off' position while the connections are made and until the test is ready to be performed.

CHARGING THE BATTERY

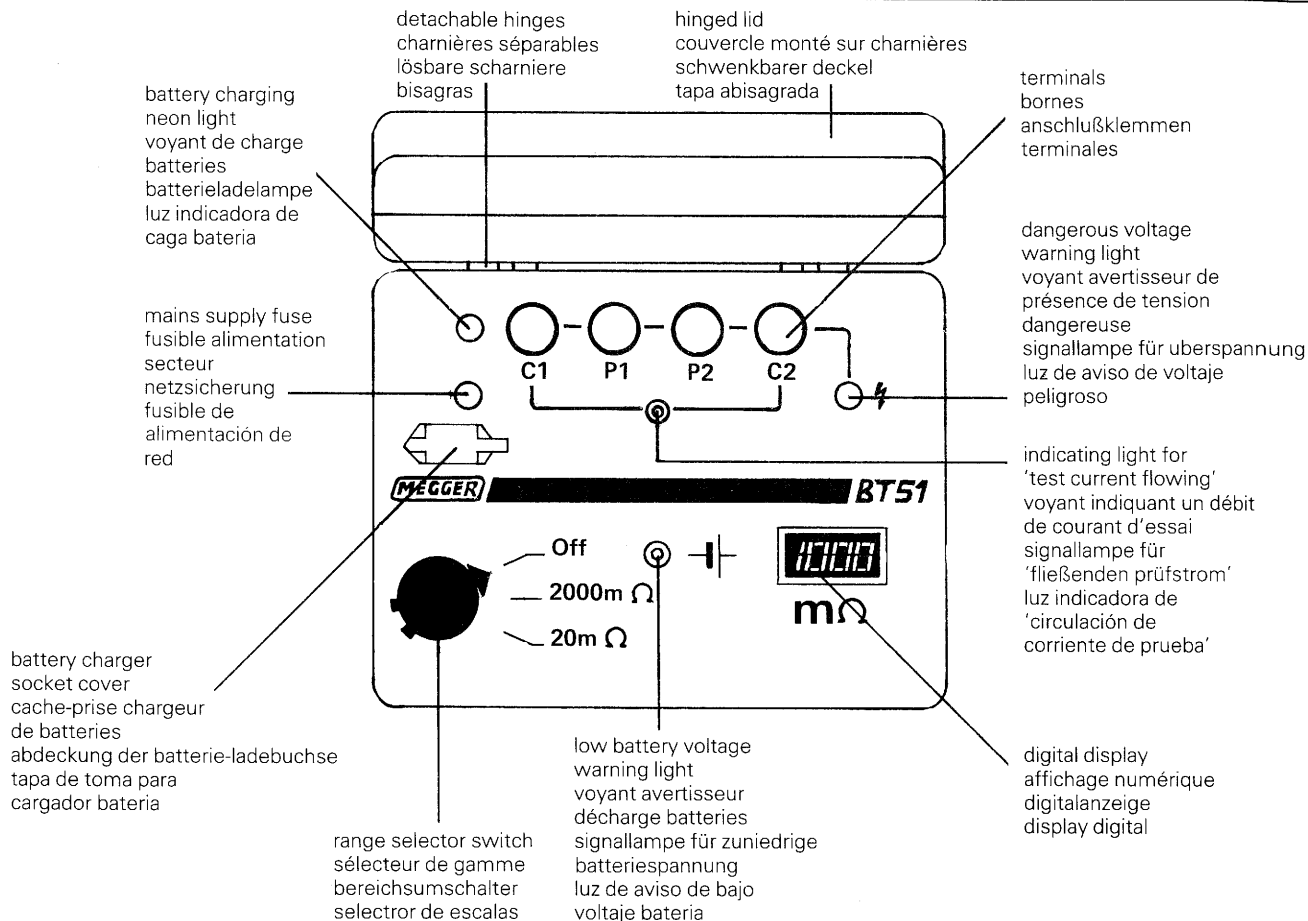
If while performing a test the "low battery voltage" warning light illuminates, the batteries must be recharged.

1. Lift the battery charger socket cover to expose the charger socket.
2. Connect a suitable three-pin plug to the battery charger mains supply lead. Ensure that the earth wire in the supply lead is connected so that the instrument is earthed when charging the battery.
3. Plug the lead into the instrument and then into a convenient mains supply socket and switch on.
4. Allow the battery to charge for 10 hours.

Note:— The instrument may be used to perform tests during charging, providing the battery is not completely exhausted and has been allowed a little time to recover its voltage. The mains supply cannot fulfil the test current requirements without the aid of the battery. In these circumstances problems in measurement may arise due to mains interference. A longer charging time must be allowed if battery charging and testing are carried out simultaneously. The battery will not be damaged by a longer charging period.

5. After charging, switch off the mains power supply, remove the charging lead and replace the battery charger socket cover.

Outline Diagram



Mode D'Emploi

RECOMMANDATION

S'assurer que l'équipement (ou le conducteur) à essayer se trouve hors tension avant d'y relier l'appareil.

DEPOSE DU COUVERCLE

Si nécessaire, le couvercle peut être déposé pendant l'utilisation de l'appareil. Il suffit d'ouvrir celui-ci complètement et d'appliquer une pression sur son bord d'ouverture, tout en maintenant fermement le boîtier de l'appareil; les charnières se séparent alors.

Pour remettre le couvercle en place, le présenter verticalement et enfoncer les charnières dans leurs dispositifs de retenue, tout en maintenant l'appareil, puis fermer le boîtier.

EXECUTION D'UN ESSAI (avec pointes de touche doubles)

1. Brancher les cordons d'essai sur les bornes de l'appareil: les cordons d'intensité sur C1 et C2 les cordons de tension sur P1 et P2.
Les jeux de pointes de touche livrés par le constructeur sont équipés de cordons noirs pour le circuit courant et rouges pour le circuit potentiel.
2. Mettre le sélecteur de gamme sur la position appropriée.
3. Appliquer les deux jeux de pointes de touche sur un morceau de métal de faible résistance, de façon à ce que les pointes soient aussi près que possible les unes des autres.
L'afficheur numérique doit indiquer zéro.
Remarque: Le voyant vert est allumé quand le courant d'essai circule entre les bornes C1 et C2.
4. Appliquer les pointes de touche sur l'équipement ou le conducteur à tester.
5. Lire la résistance indiquée par l'afficheur numérique.
6. Un dépassement de gamme est indiqué par un 'I' à l'extrême gauche de l'afficheur le reste de celui-ci étant éteint. Si le signe de dépassement apparaît sur la gamme 20 m Ω , passer sur la gamme 2000 m Ω . S'il persiste sur cette gamme, ceci indique que la valeur de la résistance à mesurer est hors gammes de cet appareil.
7. Après essai, retirer les pointes de touche, mettre le commutateur de sélection sur "OFF" (Arrêt) et débrancher les cordons.

ATTENTION: Quand on utilise l'appareil pour effectuer des mesures sur charge inductive, des surtensions peuvent apparaître aux bornes de l'appareil, lors de changements de gamme, ou quand on branche ou débranche les cordons de mesure. L'appareil est protégé contre ces phénomènes pour des charges n'excédant pas 250 mH (cordons de mesure inclus).

UTILISATION D'AUTRES CORDONS

Si l'on utilise des cordons équipés de pinces, il est important d'établir d'abord le circuit courant, puis de faire passer le sélecteur de la position 'OFF' à la gamme appropriée. La lecture est obtenue quand les conducteurs de potentiel (pointes de touche ou pinces) sont mis en contact avec la structure en essai.

Le courant d'essai circule entre C1 et C2 uniquement quand le circuit complet est établi. Le passage du courant est indiqué pour une illumination de voyant vert.

La durée de l'essai doit être la plus courte possible afin de préserver l'énergie des batteries.

CHARGE DES BATTERIES

Les batteries doivent être rechargées dès que le voyant avertisseur de tension minimum s'allume.

1. Dégager le cache prise chargeur de batteries.
2. Brancher dans cette prise le cordon d'alimentation fourni, et relier ce cordon au secteur par une prise munie d'une borne de terre afin d'assurer une mise à la terre correcte de l'appareil pendant la charge des batteries.
3. Laisser les batteries en charge pendant 10 Heures.
L'instrument peut être utilisé pour effectuer des mesures pendant la charge, après toutefois un temps minimum de recharge. En effet, si les batteries sont complètement déchargées, l'alimentation secteur n'est pas suffisante pour fournir seule le courant nécessaire aux mesures. D'autre part, des problèmes peuvent surgir dans les mesures à cause des interférences du réseau.
Dans ce type d'utilisation, un temps supérieur de charge est nécessaire, mais il n'y a aucun risque d'endommagement des batteries.
4. En fin de charge, couper l'alimentation secteur, débrancher le cordon du chargeur et remettre le couvercle cache prise en place.

Kurzanweisungen

ACHTUNG!

Vor Anschluß des Geräts ist sicherzustellen, daß die zu prüfenden Anlagen bzw. Verkabelungen abgeschaltet sind.

ABNEHMEN DES DECKELS

Falls notwendig, kann der Deckel entfernt werden, indem er einfach unter Festhalten des Gerätekörpers durch Druck auf die Öffnungskante nach unten gedrückt wird. Die Scharniere schnappen dann aus. Zum Wiedereinsetzen des Deckels ist er vertikal zu halten damit die Scharniere wieder in ihre Klammern ein schnappen, während das Gerät festgehalten wird. Der Deckel kann wieder geschlossen werden.

DURCHFÜHREN EINER MESSUNG (unter Verwendung von doppelten Handspitzen).

1. Die Prüfleitungen an die MEß-geräteklemmen anschließen. Stromleitungen an C1 und C2, Spannungsleitungen an P1 und P2. Anmerkung: Die von **Megger Limited** gelieferten doppelten Handspitzengarnituren sind mit schwarzen Stromleitungen und roten Spannungsleitungen versehen.
2. Den Bereichumschalter auf die entsprechende Schalt-Stellung setzen.
3. Beide Handspitzengarnituren mit einem niederohmigen Metallstück in Berührung bringen, so daß die Spannungsspitzen so nahe wie möglich beieinanderliegen. Dabei soll Null in der Digitalanzeige erscheinen. Anmerkung: Bei fließendem Prüfstrom zwischen den Klemmen C1 und C2 leuchtet die grüne Signallampe.
4. Die Handspitzengarnituren auf die zu prüfenden Geräte bzw. Leiter drücken.
5. Den gemessenen Widerstandswert von der Digitalanzeige ablesen.
6. Das Überlaufsymbol ist eine 'I' auf der linken Seite der Digital Anzeige, wobei die restlichen Ziffern gelöscht bleiben. Erscheint dieses Symbol bei Benutzung des 20 m Ω -Bereiches, so ist der 2000 m Ω -Bereich zu wählen. Bei Erscheinen des Symbols im 2000 m Ω -Bereich ist der gemessene Widerstandswert außerhalb des Geräte-Meßbereichs.
7. Nach dem Test die Prüfspitzen abklemmen den Wählschalter auf "Aus" ("off") stellen und die Prüfleitungen abtrennen. ACHTUNG! Wird das Instrument zur Prüfung einer induktiven Belastung verwendet, tritt an den Klemmen eine kurze Spannungsüberhöhung auf. Dies ergibt sich, wenn das

Instrument von einem Meßbereich auf den anderen geschaltet wird oder die Prüfleitungen angeschlossen oder abgetrennt werden. Das Instrument kann solchen.

Spannungsspitzen bei Messungen induktiver Lasten (darunter auch der Prüfleitungen) bis zu 250 mH standhalten.

VERWENDUNG ANDERER LEITUNGEN:

Bei Verwendung von Prüfstromleitungen mit Verbindungsklemmen und dergleichen sind die Verbindungen zuerst herzustellen und dann der Wählschalter aus der 'Aus'-Stellung unmittelbar vor der Messung auf den entsprechenden Meßbereich zu stellen. Eine Anzeige wird erhalten bei Anschluß beider Spannungsverbindungen, d.h. über einzelne Handspitzen bzw. über eine Handspitze und eine Klemme. Sobald der Stromkreis zwischen C1 und C2 geschlossen ist, fließt Prüfstrom, angezeigt durch die grüne Signallampe, es sei denn, der Umschalter ist in der 'Aus'-Stellung.

Im Interesse einer langen Batteriestandzeit sind die Meßzeiten so kurz wie möglich zu halten.

AUFLADEN DER BATTERIE

Sobald die Signallampe für zu niedrige Batteriespannung aufleuchtet, muß die Batterie aufgeladen werden.

1. Zur Freigabe der Ladebuchse die Abdeckung umschwenken.
2. Einen geeigneten Stecker an die Netzleitung des Ladegeräts anschließen. Dabei sicherstellen, daß die Erdader in der Netzleitung vorschriftsmäßig angeschlossen ist, damit das Gerät bei Laden der Batterie geerdet ist.
3. Die Leitung in das Gerät einstecken, dann in eine geeignete Netz-Steckdose und einschalten.
4. Die Batterie min 10 Stunden aufladen. Das Instrument kann auch während des Ladens für Prüfungen eingesetzt werden, sofern die Batterie nicht ganz erschöpft ist bzw. einen Teil ihrer Spannung in einer kurzen Ladungsphase zurückgewinnen konnte. Die Netzversorgung der Ladeeinheit kann den Teststromerfordernissen nicht ohne Batterie gerecht werden. Auch treten bei Netzstörungen bedingte Meßprobleme auf. Erfolgt Laden der Batterie und Messung gleichzeitig muß eine längere Ladezeit vorgesehen werden. Die Batterie nimmt dadurch keinen Schaden.
5. Nach dem Aufladen das Netz abschalten, die Ladeleitung entfernen und die Ladebuchse wieder mit dem Deckel verschließen.

Instrucciones Resumidas de Uso

ADVERTENCIA

Verificar que el aparato o conductor a comprobar esté sin tensión antes de conectar el instrumento.

DESMONTAJE DE LA TAPA

Se puede retirar la tapa del milióhmetro en régimen de servicio, cuando sea necesario, para lo cual basta abrirla hasta el máximo y ejercer leve presión sobre el borde de apertura mientras que se sujeta firmemente la caja del instrumento; con ello se soltarán los pasadores de bisagra. Para reinstalar la tapa, colocarla en posición vertical e introducir los pasadores en sus soportes mientras que se sujeta el instrumento, cerrando la tapa después.

REALIZACIÓN DE MEDIDAS (supuesto el empleo de puntas duplex)

1. Conectar los conductores de prueba con los terminales del instrumento (los de corriente con C1 y C2, los de potencial con P1 y P2).
Nota: Los juegos de puntas duplex suministrados por **Megger Limited** tienen conductores de corriente negros y conductores de potencial rojos.
2. Situar el selector de escala en la posición apropiada.
3. Tocar con ambos juegos de puntas una pieza de metal de baja resistencia de modo que las puntas de potencial estén lo más cerca posible una de otra. El display debe indicar cero.
Nota: Cuando la corriente de prueba pase entre los terminales C1 y C2, se encenderá a luz indicadora de color verde.
4. Tocar y apretar hacia abajo con las puntas sobre el aparato o conductor objeto de comprobación.
5. Observar la medida de resistencia en el display.
6. El símbolo de sobre-escala está constituido por la cifra '1' en el lado izquierdo, permaneciendo en blanco los dígitos restantes. Si se encuentra en uso el alcance de 20 m Ω , cuando aparezca el símbolo se debe pasar al alcance de 2000 m Ω ; si se encuentra en uso el alcance de 2000 m Ω , la resistencia a determinar excede del alcance de medida del instrumento.
7. Después de realizar la prueba, situar el selector en "off" y desconectar los conductores de prueba.

ADVERTENCIA: Cuando el aparato se utilice para medir una carga inductiva, aparecerá una tensión parásita a través de los bornes. Esto ocurre durante la conmutación entre márgenes o al conectar o desconectar los conductores de prueba. El aparato soportará las tensiones parásitas que se produzcan al medir

cargas inductivas (incluida la de los conductores de prueba) hasta un máximo de 250 mH.

EMPLEO DE CONDUCTORES ALTERNATIVOS:

Quando se utilicen conductores de corriente de prueba con conexiones de pinza o clip, será necesario hacer primero las conexiones y después pasar el selector de la posición 'off' (apagado) al alcance de medida apropiado, inmediatamente antes de efectuar una medida. Se podrá obtener una lectura después de establecer también las dos conexiones de potencial, por medio de puntas individuales o de una punta y un clip. A menos que el selector se encuentre en la posición de apagado, tan pronto se establezca el circuito entre C1 y C2 empezará a circular la corriente de prueba, según la indicación proporcionada por la luz verde. Para conservar la carga de la batería, mantener el tiempo de prueba lo más corto posible.

CARGA DE LA BATERÍA:

Será necesario recargar la batería cuando se encienda la luz de aviso de 'bajo voltaje batería'.

1. Destapar el conector correspondiente al cargado de batería.
2. Colocar una clavija apropiada en el cable de alimentación del cargador, verificando que el hilo de tierra de dicho cable comunique con tierra mientras se esté cargando la batería.
3. Enchufar el cable al instrumento y conectarlo con una toma a red apropiada seguidamente conectar la tensión de red.
4. Dejar transcurrir 10 horas para que se cargue la batería. El aparato puede emplearse para efectuar pruebas en régimen de carga, siempre que la batería no esté completamente agotada y que se le haya dejado recuperar su tensión durante un breve espacio de tiempo. La red de alimentación no puede suministrar la corriente necesitada para la prueba, a menos que esté complementada por la batería. En estas condiciones, pueden surgir problemas durante la medición debido a interferencias en la red.
Será preciso alargar la duración del período de carga si se ha de cargar la batería coincidiendo con la realización de la prueba. El alargamiento de dicho período no ocasionará perjuicios a la batería.
5. Efectuada la carga, interrumpir la alimentación de la red, retirar el cable de carga y cerrar la tapa del conector correspondiente al cargador.

Circuit Description

(refer to circuit diagram)

MEASUREMENT AND DISPLAY

The BT51 measures resistance ratiometrically, detecting the current through and the voltage across the unknown resistance R_x and performing the sum $R_x = V_x/I_x$. Because of this ratiometric method, a constant current supply is not necessary and a current limit circuit is adequate. The display is driven directly from the A/D converter integrated circuit and the only additional items required are the integrating components C11 and R32, the auto-zero capacitor C12, the reference capacitor C14 and the oscillator components C15 and R33.

Measurement is performed by monitoring, the voltage across the unknown (at the input terminals of the A/D converter), and the voltage proportional to the current through the unknown, (and sensed across a manganin resistor R25 in series with the unknown), at the reference terminals of the A/D converter.

CURRENT LIMIT

The current limiting circuit containing R13, R14, R15, R21, TR7 and TR9 maintains the test current at nominally 2 A. R21 provides the base current to make TR9 conduct and a voltage drop occur across R13, R14 and R15 (assuming the 'C' leads are shorted). When the voltage across these parallel resistors reaches the V_{be} of TR7, this transistor starts to conduct thus reducing the base current of TR9. The value of the parallel resistor combination defines the current limiting value. A L.E.D. L2 and resistor R20 are connected across the current limiting circuit such that, with no voltage drop across that circuit (i.e. with the 'C' terminals open circuit and no test current flowing) the L.E.D. is off. When test current flows a voltage drop exists across the current limit circuit and the L.E.D. will be illuminated.

PROTECTION CIRCUIT

The relay cannot be energised with the instrument turned off, therefore the terminals are isolated from the circuitry, although neon light N2 will still indicate if high voltage is applied between the terminal pairs C1/P1 and C2/P2. With the instrument switched on and the terminals open circuit, TR1 is made to conduct via R4, R9 and D3 and the voltage on C1 is held low. Current flows in the base of TR4 keeping TR3 non-conducting and the relay in the 'safe' condition.

The application of a short circuit (or the unknown resistance) across the terminals causes TR1 to stop conducting, C1 charges to almost battery voltage level and TR4 stops conducting. This causes TR3 to turn the relay on and TR5 maintains this situation until the unknown resistance is removed.

TR2 operates as TR1 for reverse polarity voltages and together they protect the circuit against a.c. voltages. Open circuits or voltages across the terminals maintaining TR1 or TR2 conducting keeps the relay off and the circuit protected.

AMPLIFIER

The 2000 m Ω range does not require an amplifier, the voltage across the unknown is attenuated by R22 and R26 and fed directly to the A/D converter inputs. The reference voltage is obtained from R25, and R35 is used to adjust full scale

On the 20 m Ω range the voltage across the unknown is amplified by the integrated circuit IC2. This is a chopper stabilized op. amp. and is connected in the non-inverting mode. The gain is determined by R28, R23 and R24, and R34 is used to adjust full scale. C8 and C9 are required for storing correcting potentials. The output of the amplifier is fed via R30 and R26 to the A/D converter.

Accessories

BATTERY LOW AND CHARGING CIRCUIT

R10, R11 and R12 form an attenuator across the battery. With normal battery voltage, TR6 is conducting and TR8 non-conducting so the L.E.D. light L1 is off. When the battery voltage is low TR6 stops conducting making TR8 conducting and L.E.D. L1 illuminates.

D1, R6 and the mains transformer form the charging circuit.

Precautionary note:— The instrument circuit contains static sensitive devices. If the instrument casing is opened for any reason (this will automatically invalidate any warranty covering the instrument), care must be exercised in handling the printed circuit boards. This should be done in accordance with DEF STN 59-98 and BS 5783, specifications for handling electrostatic sensitive devices.

ACCESSORIES

Supplied with the instrument

Supply lead for battery charging	Part No. 25424-860
Duplex handspikes with 2,5 m (8 ft) test leads	Part No. 6111-022
User Guide	Part No. 6170-921

ACCESSORIES

Supplied at extra cost

Duplex handspikes with 6,1 m (20 ft) test leads	Part No. 6111-023
Duplex handspikes with 9,1 m (30 ft) test leads	Part No. 6111-024
Pair of single handspikes with 1,8m (6 ft) test leads	Part No. 6130-516
Four terminal lead set with clip connectors	Part No. 6110-220
Accessory pouch, leather	Part No. 6430-193

Repair and Warranty

The instrument circuit contains static sensitive devices, and care must be taken in handling the printed circuit board. If the protection of an instrument has been impaired it should not be used, and be sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if, for example, the instrument shows visible damage, fails to perform the intended measurements, has been subjected to prolonged storage under unfavourable conditions, or has been exposed to severe transport stresses.

New Instruments are Guaranteed for 1 Year from the Date of Purchase by the User.

Note: Any unauthorized prior repair or adjustment will automatically invalidate the Warranty.

Instrument Repair and Spare Parts

For service requirements for **Megger** Instruments contact:

Megger Limited	or	Megger
Archcliffe Road		Valley Forge Corporate Center
Dover		2621 Van Buren Avenue
Kent, CT17 9EN.		Norristown, PA 19403
England.		U.S.A.
Tel: +44 (0) 1304 502243		Tel: +1 (610) 676-8579
Fax: +44 (0) 1304 207342		Fax: +1 (610) 676-8625

or an approved repair company.

Approved Repair Companies

A number of independent instrument repair companies have been approved for repair work on most **Megger** instruments, using genuine **Megger** spare parts. Consult the Appointed Distributor / Agent regarding spare parts, repair facilities and advice on the best course of action to take.

Returning an Instrument for Repair

If returning an instrument to the manufacturer for repair, it should be sent freight pre -paid to the appropriate address. A copy of the Invoice and of the packing note should be sent simultaneously by airmail to expedite clearance through Customs. A repair estimate showing freight return and other charges will be submitted to the sender, if required, before work on the instrument commences.

Components List

MAIN P.C.B.

R1	Resistor	1k Ω $\pm$ 2%	1/2 W
R2	Resistor	22 k Ω $\pm$ 2%	1/2 W
R3	Resistor	22 k Ω $\pm$ 2%	1/2 W
R4	Resistor	1 M Ω $\pm$ 2%	1/2 W
R5	Resistor	24 k Ω $\pm$ 2%	1/2 W
R6	Resistor	5,6 Ω $\pm$ 5%	2,5 W
R7	Resistor	100 k Ω $\pm$ 2%	1/2 W
R8	Resistor	1,6 k Ω $\pm$ 2%	1/2 W
R9	Resistor	10 k Ω $\pm$ 5%	2 W
R10	Resistor	150 k Ω $\pm$ 2%	1/2 W
R11	Potentiometer	10 k Ω $\pm$ 20%	0,1 W
R12	Resistor	12 k Ω $\pm$ 2%	1/2 W
R13	Resistor	1 Ω $\pm$ 5%	2 W
R14	Resistor	1 Ω $\pm$ 5%	2 W
R15	Resistor	1 Ω $\pm$ 5%	2 W
R16	Resistor	150 k Ω $\pm$ 2%	1/2 W
R17	Resistor	100 Ω $\pm$ 2%	1/2 W
R18	Resistor	750 k Ω $\pm$ 0,5%	1/2 W
R19	Resistor	150 Ω $\pm$ 2%	1/2 W
R20	Resistor	430 Ω $\pm$ 2%	1/2 W
R21	Resistor	39 Ω $\pm$ 5%	2,5 W
R22	Resistor	30 k Ω $\pm$ 1%	1/2 W
R23	Resistor	1,6 k Ω $\pm$ 1%	1/2 W
R24	Resistor	2 k Ω $\pm$ 2%	1/2 W
R25	Resistor	0,1 Ω manganin (part no. 5160-067)	
R26	Resistor	2,7 k Ω $\pm$ 1%	1/2 W
R27	Resistor	51 k Ω $\pm$ 1%	1/2 W
R28	Resistor	51 k Ω $\pm$ 1%	1/2 W
R29	Resistor	510 Ω $\pm$ 2%	1/2 W
R30	Resistor	6,8 k Ω $\pm$ 1%	1/2 W
R34	Potentiometer	470 Ω $\pm$ 20%	0,75 W
R35	Potentiometer	22 k Ω $\pm$ 20%	0,75 W
R36	Resistor	510 k Ω $\pm$ 2%	1/2 W
R37	Resistor	510 k Ω $\pm$ 2%	1/2 W

C1	Capacitor	1 μ F $\pm$ 20%	63V
C2	Capacitor	10 μ F	16 Velectrolytic
C3	Capacitor	47 pF $\pm$ 2%	63 V
C5	Capacitor	47 pF $\pm$ 2%	63 V
C6	Capacitor	10 μ F	16 Velectrolytic
C7	Capacitor	47 pF $\pm$ 2%	63 V
C8	Capacitor	100 nF	12 V
C9	Capacitor	100 nF	12 V
C10	Capacitor	47 pF $\pm$ 2%	63 V
C16	Capacitor	47 pF $\pm$ 2%	63 V
C17	Capacitor	470 μ F $\pm$ 20%	16 V

D1	Diode	1N5400
D2	Diode	1N4148
D3	Diode	1N4007
D4	Diode	1N4148
D5 to D8	Diode	1N4004
D10	Zener diode	1N5337 B
D11	Zener diode	1N5337 B
D12	Diode	1N4148
D13	Diode	1N4004
D14	Diode	1N4148
D15 to D17	Zener diode	1N5346B

TR1	Transistor	BC183C
TR2	Transistor	BC183C
TR3	Transistor	BC213C
TR4	Transistor	BC213C
TR5	Transistor	BC213C
TR6	Transistor	BC183C
TR7	Transistor	2N2905
TR8	Transistor	BC183C

IC1	Integrated circuit	ICL 7660CPA	N2	Neon indicator light	Part No. 25990-011
IC2	Integrated circuit	ICL 7650CPD	T1	Transformer	Part No.6180-420
FS2	Fuse 3, 15 A	Part No. 25413-280	TR9	Transistor PNP3055	
RL1	Relay 6 V d.c. 100Ω	Part No. 25484-519	LED 1	Light emitting diode (red)	Part No. 28863-281
			LED 2	Light emitting diode (green)	Part No. 28863-282

DISPLAY P.C.B.

R31	Resistor	1 kΩ ± 2%	1/2 W
R32	Resistor	47 kΩ ± 2%	1/2 W
R33	Resistor	100 kΩ ± 2%	1/2 W
R38	Resistor	510 kΩ ± 2%	1/2 W

C11	Capacitor	220 nF ± 10%	100V
C12	Capacitor	47 nF ± 10%	250V
C13	Capacitor	47 pF ± 2%	63V
C14	Capacitor	10 nF ± 10%	100V
C15	Capacitor	100 pF ± 2%	63V
C18	Capacitor	47 nF ± 10%	63V

D9	Diode	1N4148
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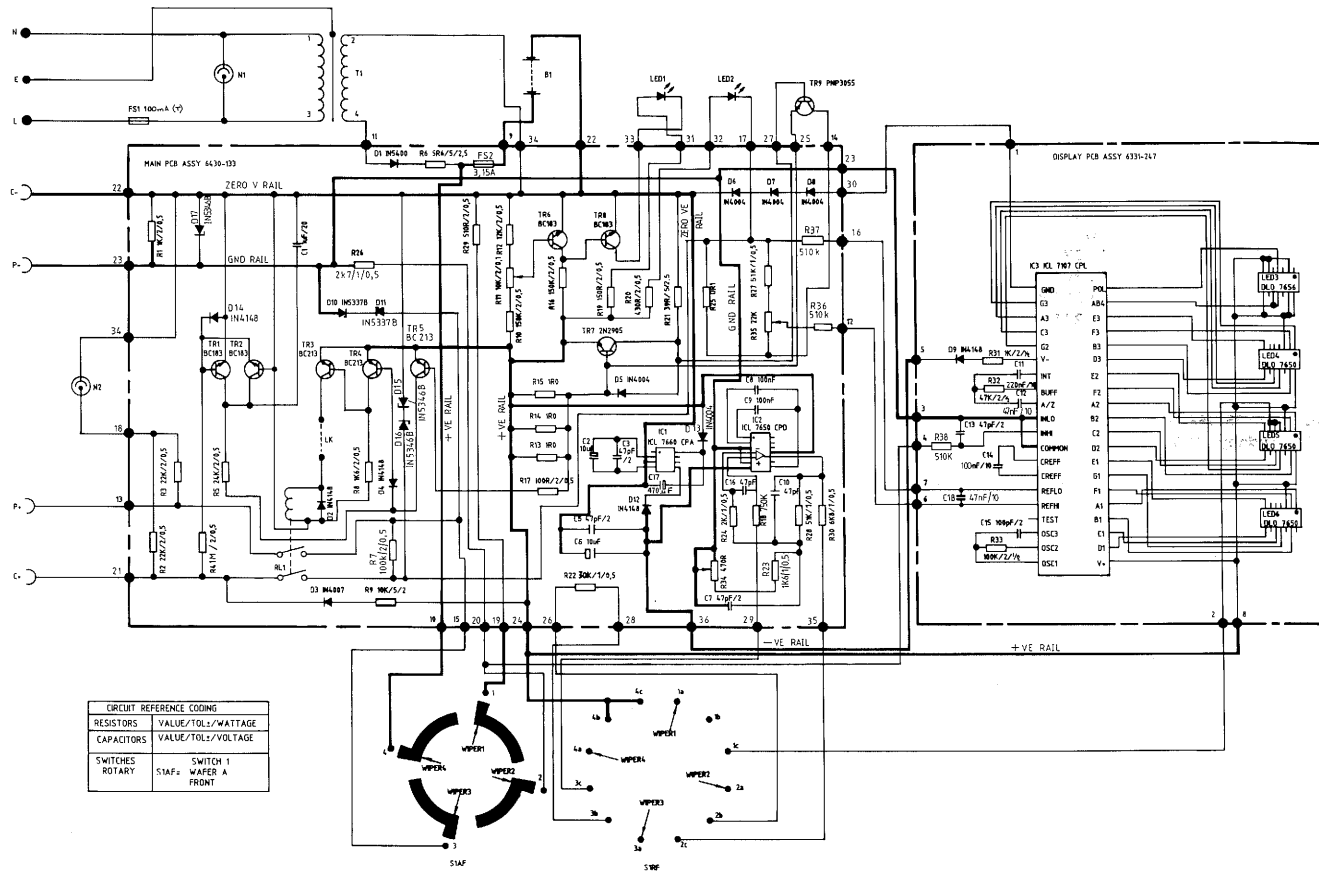
IC3	Integrated circuit	ICL 7107CPL
LED 3	Light emitting diode display	Part No. 28920-033
LED 4	Light emitting diode display	Part No. 28920-032
LED 5	Light emitting diode display	Part No. 28920-032
LED 6	Light emitting diode display	Part No. 28920-032

OTHER COMPONENTS

FS1	Fuse 100mA (T)	Part No. 25950-042
N1	Neon indicator light	Part No. 25515-652

B1	Battery pack 7,2 V NiCD	Part No. 25511-844
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Circuit Diagram



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OTHER TECHNICAL SALES OFFICES

Toronto CANADA, Sydney AUSTRALIA, Mumbai India, Madrid SPAIN and the Kingdom of BAHRAIN.

Megger products are distributed in 146 countries worldwide.

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The company reserves the right to change the specification or design without prior notice.
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